

# Materials Science and Technology Division

## Manufacturing

### Research, development, and production

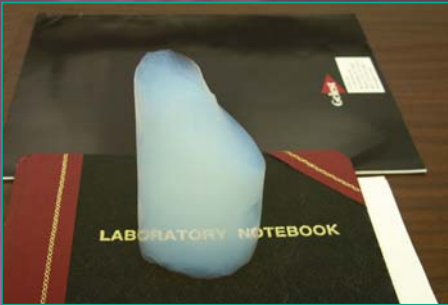
The Laboratory’s nuclear weapons program requires uniquely specialized manufacturing support. Parts must be fabricated on a range of scales that extend from the smallest achievable, the nanoscale, to the macroscale.

#### Our Capabilities

To manufacture over a wide range of scales, we maintain capabilities in ultrahigh-precision fabrication and the fabrication of exotic and potentially hazardous metals such as beryllium and uranium. We are experts in all areas of materials processing and in the development of specialized manufacturing techniques, all of which are supported by strong modeling and characterization efforts.

#### Nanoscale Manufacturing

We manufacture ultralow-density aerogels at the molecular level. Aerogels are used in experiments that benchmark weapons physics codes and verify weapons materials performance. The aerogel shown at right has a density eight times that of air. Hence, aerogels are sometimes called “solid air.”

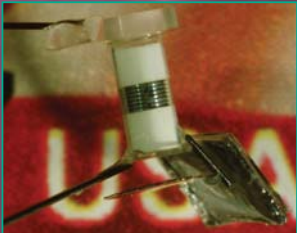


#### Macroscale Manufacturing

At the macroscale, we manufacture graphite aliquot molds used in plutonium casting at the Los Alamos Plutonium Facility. Materials engineers manufacture all the graphite hardware used in plutonium casting. The mold shown here is about 8 inches in diameter and 12 inches in height.

#### Microscale Manufacturing

(a) The cylinder mix target, a high-energy-density weapons physics target, was manufactured for studies of mix and turbulence in a convergent geometry. Not bigger than a short length of pencil lead, the target is shown (right) against letters on a U.S. postage stamp. The aluminum band was produced by electrochemistry.



(a)

(b) Another example of small-scale precision manufacturing, as well as of our advanced coating techniques, is the off-Hugoniot target. It is used to benchmark three-dimensional weapons-physics codes. The hornlike structure is about 3.6 millimeters long; the wide end of the horn is 2.2 millimeters in diameter.



(b)

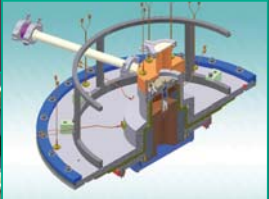


#### Plasma Spray Coating

Pictured at left is a part being manufactured by coating a copper substrate with beryllium powder. The plasma spray unit shown is the only one of its kind in the United States. Materials researchers at Los Alamos play a central role in producing and machining beryllium components for the entire nuclear weapons complex.

#### The Atlas Chamber

We designed, manufactured, and assembled major components of the vacuum envelope used on the Atlas pulsed-power machine at the Nevada Test Site. The photo at right is of the aluminum return-conductor assembly (28-inch diameter) with the vacuum envelope. The inset is a model of the assembly. Numerous design improvements were made, including reducing the number of parts by about one-third.



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